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SCIENTIFIC AFFAIRS

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CZECHOSLOVAKIA

BRIEFS

ELECTRONICS PRODUCTION INCREASING--In 1982, CSSR electronics and communications industry production is to rise 8.2 percent, with the production of microelectronic circuits rising 22 percent, control and measurement instruments 10 percent and medical technology 9 percent. Exports to socialist countries will increase more than 10 percent and to other countries almost 16 percent. [Prague ZEMEDELSKE NOVINY in Czech 11 Feb 82 p 6]

CHEMICAL TRAINING IN JAPAN--Currently, about 8,000 tons of acrylate dispersions are produced yearly at the Chemical Works in Sokolov. During the Seventh Five-Year Plan [1981-1985], this production is to increase 3-fold. In order to cope with this task, 45 workers have been selected for further training. After 6 months of language courses, 3 months of practical experience at large chemical plants, mainly at the Zaluzi near Most and Bratislava plants, will follow. Then half of these trainees, selected for positions of shift foremen, production sector chiefs, etc, will receive 3 months of training in Japan. [Prague MLADA FRONTA in Czech 4 Feb 82 p 7]

CSO: 2402/25

DECREE ON REORGANIZATION OF RESEARCH INSTITUTES PUBLISHED

Budapest IPARI KOZLONY in Hunsarian 3 Dec 81 pp 552-554

[Article by Lenard Pal: "Decree of the Secretary General of the Hungarian Academy of Sciences on the Introduction of More Open and Flexible Operations Structures of the Research Institutes"]

[Text] 1. International experience shows that the network of research institutes is continuously modernized corresponding to the actual nature of research work. Research and development shops have--according to the research-task goals and the nature of research--many organizational structures (research centers, research institutes, universities, research development companies, etc); creative work processes also as a function of the methods used, in a differentiated framework. Also in our country, it is necessary--in the interest of increasing the effectiveness of scientific research--to introduce and popularize new, more open and more flexible organizational structures and application methods allowing a better utilization of scientific potentials. These structures must serve comprehensive and successful implementation of principal research targets, programs, priority tasks, promote the use of multidisciplinary approaches and allow a better concentration of researchers working in different institutes but involved in the same task in a collective effort to achieve priority goals.

2. The nucleus of the new flixible organizational structures is already present in the organizational system of the Hunsarian research network. The research institutes are justified in the future--especially in view of the economic circumstances and requirements--to place greater emphasis on the extension of the guest-researcher and outside-colleague system, in whose framework, experts may be employed for a given length of time.

There may be numerous reasons, depending on the nature of research activities, for the admission of guest researchers, outside colleagues:

2.1 To increase its diversification, speed and effectiveness, it may become necessary for a research facility to admit in a systematic manner, in a given area, for a given length of time the best outside experts of a specific field for a given task (e.g., national and board-level research goals, programs and other priority tasks).

2.2 Modern and highly-equipped institutes with special laboratories may permit outside experts to perform tasks necessitating modern and highly-equipped the institutes and special laboratories.

2.3 Research institutes may employ a relatively large number of young experts for a given length of time to acquaint them with research methods and involve them with research work (this function may serve postgraduate and researcher training).

2.4 Institutes with good research conditions can provide guest researchers and outside colleagues with favorable creative atmosphere, undisturbed conditions, quiet circumstances to perform a given research work.

2.5 Various temporary and multidisciplinary research associations, plants and cooperatives, etc, set up for the performance of a given task and dissolved after the completion of the task may also strive for the expansion of the employment of guest researchers and outside colleagues.

3. Parallel to the expansion of the guest-researcher and outside-colleague system, the cooperation between research institutes and cooperatives must be stregthened with special regard to the introduction of completed research results, licenses and know-how. The ties between research institutes and educational institutions must be increased; the role of scientific associations in the development of new ties and operating methods must be enhanced.

3.1 The so-called cooperation agreements or company contracts, and sometimes research and development associations, provide a good framework for the cooperation of research institutes and cooperatives.

3.2 The ties between research institutes and educational institutions may be strengthened by united research organizations, academic departments, cooperatives, the organizations for common professional courses and the common use of experimental plants, instrument facilities, etc.

3.3 The disciplinary research and development associations, applied social sciences analysis plants, methodology centers, etc may be regarded as new-type organizations to be supported in the social sciences.

4. In the interest of further increasing of the level of scientific work, in addition to the existing organizational structures, it is justifiable to develop the framework-institute structure. In this period of intensive social and scientific development, thanks to the opportunities offered by the framework institutes, the existing and potential forces of research may be used on one hand more effectively, and on the other hand, as a result of their use, the number of creative professionals can increase.

4.1 By framework institutes, we mean that organizational and operational structure of already existing main-charter research institutes which perform their tasks with the assistance of a smaller proportion of permanent researchers and a larger proportion of temporary researchers of the total authorized number of researchers: according to this, for a given time period, they employ guest researchers or outside colleagues, based on invitations or contests. In a framework research institute, it is best to develop the proportion of permanent and temporary research personnel gradually.

4.2 The framework institute structure may be equally suitable for the fuller realization of national research potentials in the area of social, technical, agricultural, medical and natural sciences.

Institutes that are involved in priority research tasks with significant capacities and conduct multidisciplinary research may function as framework institutes. Institutes that based on their conditions are attractive to professionals showing research inclination and ability and employed in research institutes without a main charter can also function as framework institutes. A science school or special instruments, the opportunity to acquire modern research methods and technologies, etc, can be of this nature. Occasionally, some circumstances (e.g., the proximity to Lake Balaton) may serve as a basis for the realization of the framework-institute status.

4.3 As far as possible, the permanent staff of the framework institutes should be made up of experienced and recognized researchers and personnel capable of satisfying local research requirements (machines, instruments, computer centers, information supply).

Guest researchers and outside colleagues should preferable be selected from two sources:

--from the circle of research- and development-type experts and non-research- and development-type practical experts.

--from the circle of university (college) educational researchers partially or fully exempted of educational duties, who can take advantage of the capacity of the frame institute for the realization of a concrete task.

Occasionally, personnel of other work situations can also be considered who, for instance, accept assignments in framework institutes to perform an attractive task, or if their employer considers their assignment in a framework institute useful.

The framework institute will offer employment to the guest researcher and outside colleague from 3 months to 3 years, which can be extended in exceptional cases to a maximum of 5 years.

4.4 During the period of employment in a framework institute, the original work relation of the guest researchers and outside colleagues is not terminated. Their salary is covered in the following manner:

--the institutes charge against their own salary budget the salary of the guest researchers and outside colleagues for a given period of time, based on their original employer's assignment.

--or the original employer pays the guest researchers and outside colleagues and sends them to the framework institutes for job assignments.

A combination of the above two methods may also be justifiable to make selection as broad as possible and allow the most research-qualified personnel join the framework institutes. In both cases, the final decision in the selection of the person is made by the framework institute.

In the case of an assignment, an agreement dealing with employer rights and obligations toward the employee must be made between the framework institute and the original employer. The agreement must regulate the length of the assignment, the location of the job, tasks, salary, allowances and compensations, etc. The employer's rights are determined by the director of the receiving institute, except for the termination of the work relation.

In the case of an assignment exceeding 3 months, the agreement of the employee must also be secured taking into account labor regulations.

4.5 In the framework institute, the basic activity--as far as this can be established--will be institute-financed or task-financed, and the varying tasks--if possible--task-financed.

4.5.1 The institutes will mostly cover their framework-institute-related functions from their own financial means. If the framework institute is reimbursed by the organization sending the guest researcher or outside colleague, the income accrued can be used by the framework institute for scientific goals, in accordance with the appropriate rules.

4.5.2 The supervisory organs will support the functions of the framework institutes even financially and provide from their own reserves additional financial sources to the framework organizations. Those researchers successfully performing as guest researchers or outside colleagues in framework institutes should be morally and materially recognized.

4.5.3 In case a guest researcher, outside colleague finds employment away from his residence in a framework institute, his extra expenses (room and board) must be covered from the domestic research-trip funds.

4.5.4 It must be achieved that the guest researcher, outside colleague is not placed in a financially disadvantageous situation (in his personal income) relative to a similar-quality permanent researcher of the institute, and if he returns to his original employer, his higher qualifications must be appropriately rewarded.

5. To promote the application of guest researchers and outside colleagues and facilitate their admittance, the institutes will disclose and point out those research opportunities and work situations which may be applicable to the workers of various institutions interested in research work. Thus, to the required degree, they will publicize their research tasks, programs the opportunities of creative scientific work (library, instruments, publishing, international relations, etc). The directors of the framework institutes should take liberal advantage of the opportunity to invite guest researchers, outside colleagues and call contests for the employment of experts to perform the research of an important subject.

CSO: 2502/35

HUNGARIAN GENETIC ENGINEERS SYNTHESIZE VASOPRESSIN GENE

Budapest NEPSZABADSAG in Hungarian 15 Jan 82 p 5

[Report on interview with Dr Csaba Kari, physician, Dr Andras Simoncsits, chemist and Imre Cserpan, chemist; Institute of Genetics, Biology Center of Szeged, by an unidentified reporter of the newspaper: "Results by Three Young Researchers From a Young Research Institute"; date of interview not given]

[Excerpt] Last year, on a dark, late-November morning, three young men bent excitedly over a newly developed film in one of the laboratories of the Genetic Institute at the Biology Center of Szeged (SZBK). The large film meant nothing to the uninitiated: it contained parallel, long and shorter, dark and even darker bands. However, after some measurements and calculations, the three men could view this film as a trophy. This last control test also confirmed the fruitfulness of their work. And during the "SZBK Days," the scientific lecture series starting on that same day--the 26th of November--they could discuss not merely their research but also their success.

The first gene synthesis in Hungary had been carried out by Dr Andras Simoncsits, Imre Cserpan and Dr Csaba Kari. Only five countries could boast with such an achievement before, the Soviet Union being the only socialist country among them.

A few days after the successful report, I sat with them in one of the SZBK offices. However, before reporting our conversation on how these three--whose combined age is less than a hundred years--achieved this result in one of the youngest research institutes of the nation, some scientific background has to be reviewed....

Dr Csaba Kari, the head of the group, is a 39 year old physician, the 32 year old Dr Andras Simoncsits and the 25 year old Imre Cserpan--who received his diploma the same year--are chemists.

[Question] Why did you start the research on gene synthesis?

[Answer] Because, in the near future, this will become an indispensable method in modern molecular biological research. Otherwise our work is closely associated with a scientific "hit tune" of recent years, with the research trend referred to as genetic engineering which has been conducted successfully for several years at the SZBK. Thus, these scientific studies can also be brought considerably more up to date.

The gene, which was produced by the researchers at Szeged after a surprisingly short investigation period, controls the production of the protein, vasopressin (VP), by the human organism. VP is produced by the pituitary. Its function is illuminated by our knowledge of the events associated with damage to the pituitary, caused by accident or disease, when VP production ceases or is reduced. One becomes ill, the main symptom being a tremendously large daily fluid excretion which can reach as much as 25 liters! Such patients need vasopresin therapy for the rest of their lives.

Luck but No Accident

[Question] Why did you choose precisely VP-gene synthesis for your research?

[Answer by Dr S.] We decided on VP gene production after considerable study and evaluation. Our primary consideration was that the VP gene has not been previously synthesized anywhere. Of course, one of the prerequisites for our work was that the amino acid sequence of VP is known and thus we could write the nucleotide sequence of the coding gene. At the same time, it was to our advantage that the VP molecule--consisting of nine amino acids--is short enough to make synthesis of its gene a realistic goal on the one hand, and, on the other hand, it is long enough to require using all of the techniques necessary for gene synthesis for its production. We thought that this may serve as a good basis for making the synthesis of longer genes a realistic goal in the future.

Of course, the history of the success achieved in less than a year dates back somewhat further. It began--and without it they could not have done it--with five years of nucleotide research by Dr Simoncsits. After that, in 1977, he went to Cambridge, England on a one-year grant where he worked in the group of Frederick Sanger who received his second Nobel prize shortly thereafter. During this time, a completely new method had been worked out by Dr Simoncsits jointly with a colleague. To determine the sequence of nucleotides, the basic units of nucleic acids, this method had been adopted by researchers very rapidly and is still being used world-wide.

On his return, he again worked with nucleotides. At about this time came the scientific report that the gene of human insulin had been synthesized in the USA.

[Answer by Dr K.] After a thorough study of this report, I asked Andras to set up the chemical DNA synthesis which he accepted willingly. We could think of this only because one of the basic requirements of setting up a chemical DNA synthesis is familiarity with nucleotide chemistry as well as with the sequencing of the nucleotide components of nucleic acid. Because he already had sufficient experience in both areas, we thought that we had a realistic basis for him to start the new work. Our recommendation was immediately accepted by the director of our institute and he gave us maximal moral and material support. Therefore, we can say that we were lucky but this luck was not entirely accidental.

After the necessary preparations, the research in DNA synthesis was started by Dr Simoncsits in the fall of 1980. In the first phase, he synthesized more than 20 modified derivatives of the four basic units of DNA. Subsequently, these had to be combined in such a manner as to follow each other in the correct sequence. Within about half a year, he succeeded in synthesizing a DNA section consisting of 12 nucleotides. After this, they started the VP gene synthesis but by then the work was considerably accelerated.

[Answer by Dr S.] An additional factor was that, in early September, Imre Cserpan joined us as central assistant appointed by the secretary general of the Academy. He can also consider himself lucky. This was his first job and immediately he could be a participant in the first Hungarian gene synthesis.

[Answer by Dr K.] Again, this also is not an accident. Because our young colleague had worked at the Enzymological Institute of the SZBK already during his student years where he got very good training for research. It is also important that he knew English well because this is indispensable today for keeping abreast of the professional literature. He made a valued contribution to solving the problem.

The VP gene synthesis was begun by producing six DNA segments consisting of 12-15 nucleotides. This required about 150 chemical steps, carried out by Dr Simoncsits and Imre Csepan, because it is a work for chemists. By coupling the segments--which is the result of Dr Kari's work--the VP gene was finally formed. This was labelled with radioactive phosphorus. Its radiation--by producing the black band at the correct location of the film already mentioned in the introduction--revealed that the work had been successfully completed.

What Next?

[Answer by Dr K.] Here we will have to separate the further fate of the gene from our later work. Namely, further work with the gene is no longer our task. It will have to be transferred to the other side of the corridor where a group very experienced in gene splicing will incorporate it into a bacterium in such a manner that the bacterium should express it, that is, produce the VP. This is no small task just as it is no small task to obtain in completely pure form the VP synthesized in the bacterium. This in turn will be the task of the Enzymology Institute which is engaged in protein chemistry. In addition, the gene can also be used to determine the as yet unknown site of the VP gene in the human chromosome by the Somatic Cell Genetric Group of the Genetics Institute.

[Answer by Dr S.] Our future work will also be to attempt the synthesis of larger genes as well as to syntehsize the so-called "regulator" DNA segments which guide the expression of the individual genes. This is extremely important for basic research.

However, in addition to basic research, they also undertake practical tasks. The Pharmaceutical Works of Kobanya has been interested in their work from the beginning and has also provided material support. The Reanal Fine Chemical Works wishes to market the basic chemicals needed for gene synthesis. (These are currently marketed by only a single company in the world!) The Institute of Pharmaceutical Research requested special DNA segments for the gene splicing work conducted there. In addition, all three institutes wish to introduce the method and the necessary training of specialists was also accepted by the group in Szeged. This leads us far, however.

It is not the first time that the Biological Center of Szeged has produced significant results which increase its prestige and thereby the prestige of Hungarian science.

2473
CSO: 3502/36

DETAILS OF MICROELECTRONICS PROGRAM PUBLISHED

Budapest FIGYELO in Hungarian 20 Jan 82 pp 1, 7

[Article by Breitner: "Run to Stay in Place"]

[Text] The Hungarian electronics industry appeared to be just about cursed. While the important profession and the large number of interested people continued to savor with jealousy the news from abroad concerning the advance of microelectronics, domesitcally the well-informed only talked about bitter arguments, in-progress proposals, rejected concepts and indecision.

Last year, on 23 December, as a Christmas present for the profession, the new government decision was finally made, establishing for the next 10 years the task of the microelectronics component manufacturing and developmental directions. We would narrow the contents of the development program accepted by the government if we only considered manufacturing, since research and development, sales and training make also an important part of it.

We do not need to be fortune-tellers to guess--especially if we are aware of the past--that not every one welcomed this development program with bursting enthusiasm. Nor do those developing the program state (or could state) that the concept is free of compromise and that on certain points expectations did not have to be brought in line with reality. It would have been rather dangerous to make irreversible decisions even just 10 years in advance in this rapidly developing field. Thus the 10-year conception treats the two 5-year periods (1981-85 and 1986-90) to some extent distinctly, i.e., at the end of this planning period the program must be reexamined.

Development Scope

The government decision at the end of 1981 has been based on the following facts, data and market tendencies. One on hand, in July 1981, at the conference of the COMECON premiers, a general accord has been signed dealing with "the multifaceted cooperation concerning the uniform basis of electronics products, the equipment necessary for their production, the production of semiconductors and special materials."

In the Soviet Union, electronics parts manufacturing is well developed and at a high level. In the GDR, in 1977, a 20-billion forint value integrated circuit (IC) capacity was produced, and in the corresponding planning period an additional 50-billion forint sum is allocated to the development and production of newer families of parts and industrial robots. In Czechoslovakia, work is progressing according to the 8 central electronics development planning concepts worked out earlier, and our northern neighbor will spend the equivalent of 60 billion forints between 1981 and 1985. In Bulgaria, as early as 1970, they started to build the background for the electronics industry, and 4 years ago achieved the production of one of the then most modern integrated circuits (MOS-LSI). Although hitherto there are many autarchic elements in the development of socialist countries, finally the 1981 accord of premiers sets forth a coordination of the capacities to be developed in the future (including research, equipment manufacturing and production of materials). This provides the background for the Hungarian microelectronics industry.

Finally it Became a Program

In the meantime, the upward surge of the electronics industry production is uninterrupted in developed capitalist countries; in spite of the recession, it is 10-12 percent yearly. Ever newer efforts are made to design even smaller and smarter components and to realize their production technology. Taking into account the entire process, perhaps it is no longer correct to estimate the progress in generations; one can only see what the world has already achieved and the future (be this a cliche) is incalculable.

Domestically, first it had to be decided if there should be a central development project. The experience of long-range, top-managed programs influencing the production mechanism of the national economy is not always positive. The usual objection: these programs are not really relative to the market and they carry the typical traits of direct supervision systems. On the other hand, the interested parties always urged central decisions--and along with them a program--since this is the best way to get through the bureaucratic labyrinth of economic management; the supply of tools is simpler and certain other preferences are also coupled to this type of long range plans.

The State Planning Board decided already in 1979 (but even then with great delay) to have a central development program. The worsened international climate, however, changed in many respects the original idea; the originally planned license and know-how purchases had to be given up one by one in the sense of the embargo decisions. On top of this, the reasoning according to which we could buy most of the parts on the international market--even cheaper than manufacturing them domestically--became indefensible.

The socialist countries created the microelectronics product variety that would have been acceptable for the Hungarian device and equipment manufacturing industry if it appeared in the sales offering of the COMECON countries. In the current state of socialist integration, however, direct product exchange dominates. The Hungarian electronics industry, however, has nothing to offer; thus, in the long run, we cannot count on imports from this region either.

This does not mean we should strive to become completely selfsufficient. This would be on one hand impossible and on the other completely uneconomical. The task of the Hungarian microelectronics manufacturing industry is to work off with accelerated development the disadvantage which exists even compared to socialist countries and to create a merchandise base via the offering created by the increased production.

From Electron Tubes to ICs

One may lament and even learn from the downfall of the Hungarian weak-current industry. Supposedly, in the era of electron tubes, there was no significant difference between the leaders and the national industry. The disadvantage occurred during the period of transistors and is growing since. According to the experts, at the beginning of the 70s, the computer technology industry introduced the third generation, the integrated-circuit technology. But as a finished product, computer manufacturing (its related components and the device and equipment manufacturing industry at an ever increasing pace) utilized foreign-purchased ICs. The triumph of the microprocessor touched the Hungarian economy again as a consumer. According to experts, the 1977 license and know-how purchase of Eggesult Izzo--in an isolated fashion--increased at best only our IC manufacturing experiences (and in that only those relative to casing and measuring); the microelectronics industry did not make a breakthrough.

The Hungarian electronics industry with its 110,000 employees and 42-billion forint production assets is ultimately at the crossroads. Either become slowly atrophied--since it started to turn into an assembly-type operation and compete with Far-Eastern countries--or to keep its place on the international and domestic market with a comprehensive program and accelerated development, but taking into account reality. A decision advocating "running fast" was reached, allowing us to maintain our relative international position.

To Think Equipment

The concept is based on the idea not to manufacture catalogue circuits because these can be bought for pennies; the competition is enormous and there is no guaranty that these will become sellable products. Instead, equipment-oriented circuits must be designed, manufactured and sold. Moreover, the kind of circuits that accurately serve the needs of the national equipment manufacturers, since their sale--this way direct--appears more certain. (One must note, however, that 90 percent of the Hungarian industry currently uses catalogue circuits and there is the opinion that equipment-oriented circuits are only used by companies at the top of the trade. According to the technical literature, IBM in the computer industry and Hewlett-Packard in the device industry.) The production of equipment-oriented circuits is better adapted to national conditions, since according to evaluations, a large and well-trained group developed based on the few imported equipment and research.

Circuit design and so-called master mask manufacturing (making sure that design, mask manufacturing and the production of silicon chips fall into the managerial area of the same concern) are related to these as the first steps of the process. (As an explanation, using an analogy borrowed from other branch industries, the master mask is the "casting sample" or in the plastics industry, the "press.") The international market of the master mask is in the process of being established. The price of a single set--in the domain of complexity of those designed by us--is between 30,000 to 200,000 dollars. A modern mask-manufacturing machine row costs a million and a half dollars and allows the production of one mask per hour. Quick calculation shows that even in the case of masks, it is the mental effort that is payed for.

The other two main points of the microelectronics part manufacturing industry are the refinement of chips and assembly, casing and measurement. According to plans, by 1985, the matching tool park and the group of experts equipped to meet sales and technological demands will be assembled, and the internationally competitive product spectrum will be born.

For Indirect Export

The capacity to be produced must roughly correspond in size to domestic requirements. (Refer to figure.) Thus, besides national utilization, there will be goods left over that may be exchanged in international trade. According to calculations, by 1985, two-thirds of the domestic requirements will be satisfied by domestic production, and the opportunity will be offered to increase by 10 percent the 1980 socialist export; export to capitalist countries will quadruple. (The "basis" of the latter, of course, is very low.) One could say about the program that it is only indirectly export oriented.

According to the plans, in the next 10 years, the domestic microelectronics production will triple relative to its 1980 level, but as early as by 1985, it will almost double. Needless to say, the production mechanism will be completely transformed. Sixteen state and 16 cooperative enterprises will participate in the program.

Between 1981 and 1985, the initial investment of the multithrust program is 3.3 billion forints. This is significantly lower than expected by the profession and is only a fragment of a 1979-version which required 50 billion for the development of domestic microelectronics. Supposedly--although based on a later decision--an additional sum of 7.5-8 billion forints will be needed between 1985 and 1990. And it takes a good many billions to finance program-related research and development, license fees and R & D investments. Thus, the total is a significant sum.

With a Basic Allowance

Fortunately, initial investments are almost exclusively in the purchasing of machines and equipment. The companies participating in the program could not even contribute 10 percent from their financial base to the development (but this is always a characteristic trait of central development projects!) The largest money source (more than two-thirds) is covered by an installment-due basic allowance. Six hundred million in the initial investment of the whole program comes from centralized technical development funds.

There is nothing objectionable about this, since nowhere in the world did microelectronics develop without central and more or less free support. The preliminary economic calculations suggest good results. This way, the net production per employee will increase 3.5-3.7 times, and the net income of the participants 5 times. The 1980 9.4-percent net profit proportionate to production means will increase to 27-30 percent.

The lion share of the implementation of the program is entrusted to the Microelectronics Enterprise. (We hope that the company will receive a more "marketviable" name!) The primary objective for the establishment of the company is to concentrate the innovation chain into one hand. The designers' inaptitude, technological and technical "philosophy" all contributed to the fact that the national microelectronics industry achieved little success in the past, even relative to its limited potentials.

This fragmentation had, however, its advantages. The competitive situation, the competing companies reaching and renouncing temporary agreements, aimed at the ever-faster increasing of their professional knowledge. (That is why those evaluating the situation found that in the supply of leading experts, we are not doing that badly!) Professional jealousy is the possible "time bomb" of the program, even despite the gradually developing system. That is exactly why this development company should concentrate the best of the profession. The goal is to make participation in the program attractive both in the short and the long run. One must therefore agree that salaries will be increased at the beginning by 25 percent in the profession (including the new company), and, in the future, salaries will depend on profitability.

Depends on Agreement!

It is a question how the most outstanding experts who showed little readiness to cooperate in the past will work together as colleagues, subordinates and supervisors. And this is no longer a question of salaries and compensations, but rather a moral problem.

One cannot expect wonders from the microelectronics program just born. Hungary is not going to become--even if the program is perfectly implemented--a superpower of microelectronics. The conditions and opportunities mostly amount to allowing Hungary to properly equip its economy with electronics and providing a basis for exchange with socialist--and to some extent capitalist--countries in the given product line. At first glance, this is not a very large caliber task, but the most that we can do, now, at the beginning of 1982.

CSO: 2502/38

USE OF PARALLEL SYSTEMS IN HUNGARY

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 4

[Article by Akos Bodlaki: "Parallel Information Processing, Cell Automatons, Parallel Processors, Multiprocessors"]

[Text] We followed with great interest the series of articles on parallel processing, examining the subject from many viewpoints.

We are fortunate to be among the first users of parallel processor systems in Hungary, in a "sharp" application, at the upper level of the hierarchical management of the Hungarian electrical power system: namely, with a MIMD-class, multiprocessor-architecture computer system based on miniprocessors.

In this article, we deal with the architecture itself (we shall cover the application details in a later issue), furthermore, in connection with this, we shall make a few comments touching on the questions posed in the discussions which took place up to now.*

Architecture

As early as toward the end of the sixties, the problem of automatic system supervision and control were examined in the National Electrical Load Distributor (OTV). Following a very thorough and lengthy preparation, in the middle of 1976, they decided on the HIDIC-80 multiprocessor system of Hitachi. The system was delivered with the specified functions in March 1979, following a successful testing period. Its hardware and software specifications and preparation of user's software were completed with the close cooperation of Hitachi and OVT experts.

Thanks to this, the consideration worked out by us could be realized by the characteristics of the multiprocessor architecture.

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*We expected to complete the series with the publication of Subsection V which appeared in our October issue. The manuscript received in the meantime in our editorial office describes a nationally implemented successful application and considers the hitherto published articles of the series: thus it complements the subject.

Let us highlight a few system-design considerations:

--modularity, allowing the modular expansion of the system, while preserving the original system to maintain the pace dictated by the increase of tasks resulting from the technological-system and supervision-requirement growth;

--task increases must be implemented in such a manner that system throughput, the reaction time of real-time functions is not reduced;

--over 99.95 percent availability for vital on-line functions;

--the system must have a mixed-mode operation in the sense that it must allow beside the execution of on-line process-control functions the running and development of off-line programs--in the given case, using on-line technical data as input data.

The system selected (described in detail in a later issue) manages to satisfy the above stringent requirements.

Let us mention some of its typical systems characteristics:

--it can contain a maximum of eight processors;

--main modules: global memory (GM), processors, crossbar bus system with bus drives, peripherals;

--dynamic allocation capability between processors and peripherals;

--interprocessor communication: task (program registered in the operating system), synchronization, mutual diagnostic supervision, configuration control (e.g., during a switch-over);

--multiple access to given peripherals;

--dual write into duplicated memories (e.g., GM, fixed-head magnetic disks).

From the system with the above characteristics, we configured a dual-machine system that satisfied the specified tasks. The dual-machine system operates in the master-slave mode in such a manner that is satisfies the mentioned important requirements (99.95 percent availability, modularity, performance of off-line functions without a disturbance of on-line functions, etc.).

We note that the master-slave dual system can, of course, be configured from monoprocessor systems; practical experience shows, however, that even a primitive, i.e., two-processor, configuration is advantageous because of the favorable characteristics hidden in the architecture.

Based on the experience gained in OVT, we highlight the following favorable characteristics:

--offers the immediate opportunity for the implementation of a fault-tolerant system (multiple disk access, dual write, hierarchical bus system);

--response time was reduced with the sharing of the two processors for nonvital but extensive on-line functions;

--economical utilization of certain peripherals by the processors (reallocatability);

--repair of faulty peripherals during on-line operation, i.e., maintenance is possible without a disturbance of the on-line operation (reassignment to off-line processor);

--a program tested for syntax and with off-line data can easily be tested with "live" on-line process data (this may be very important during the implementation of an on-line function);

--in this type of master-slave operating mode, the switch-over in case of a faulty on-line processor is rapid and reliable (configuration control).

We mention a few arguments brought up against multiprocessor systems. For instance, a hardware failure on a given bus of the bus system paralyzes the communication between the peripherals on the bus and the processor. According to another opinion, the number of crossbar points significantly increases when a new processor and bus are added.

Our experience shows that, while these are of course true in theory, they do not play an important role, as long as the hardware--especially the bus drives and the interface circuits of the peripheral drivers, connected to the bus--is highly reliable, and the increase of the crossbar points does not cause any problems if a low number of processors and buses are used. Nevertheless, the use of more (over five) processors must be thoroughly thought out, because with an increase in the number of processors, in the case of poor system design, the overhead resulting from the interprocessor communication may significantly increase, and configuration control and the scheme for setting up spares become complicated.

OVT's hardware system is highly reliable (its availability was over 99.95 percent during approximately 2.5 years).

In practice, "bus freeze" never occurred. Moreover, the increase of crossbar points does not reach a point (and will not even in the future) which could cause problems either technically or financially. Under any circumstances, the physical implementation of points is such that these problems cannot cause any practical difficulties. Much more care must be taken in the increasing of the number of processors and buses in regard to an as simple as possible spare scheme and the overhead time resulting from interprocessor communication. These can be mastered, however, by a well-thought out assignment of the peripherals and functions to the processors (basic configuration).

Paying Special Attention to Parallel Operation

The foregoing description of the OVT's MIMD system was perhaps useful in providing the reader with the main characteristics of the system and thus will make clearer the few observations we should like to make in connection with the discussion on parallel processing in the magazine.

In the discussion, much has been said about the relationship between the parallelism of the application area and the parallel architecture of the computer system used.

As we know, there are several classes of parallel processors. It is not worthwhile to describe the classification criteria; we can easily see, however, that the particular architecture is fundamentally influenced by the level of the parallel operation. Basic instructions can be at the execution level (AP 120B), program-module or block level and at the level of well-definable functions. In a practical application, a mixture of these--e.g., a bulk processor connected to a multiprocessor system--may occur. In our opinion, it is fundamentally important to properly consider the agreement of the nature of application with the architecture used.

The management of electrical power systems is a typical area where the scope of tasks to be implemented can be divided into well-defined functions that can be conveniently divided up among processors with corresponding synchronization, but in such a manner that real-time prerequisites are not jeopardized. (Real time itself is a relative concept and reflects the application area. Moreover, even within the application area, it is a function of time. This could also be a separate topic for discussion.) In OVT, this division is only valid for a few functions due the present minimum number of processors, but one of the important points of the system development is the division of functions-partial functions among the processors. Depending on the magnitude of the task, micro- or mini-multiprocessor systems appear well suited for these and similar applications (sas-, oil-, water-supply control systems) based on foreign (American and Japanese) examples. We can mention the interesting point that a bulk processor--as a unit connected to a bus--for the performance of a large amount of arithmetic operations can also be used within this system. For example, for the performance of operations in connection with large-scale network flow and stability relations and large matrices.

One of the key questions of the discussion in the magazine involved practical application and production possibilities in our country. Cell systems were mentioned, for which producibility is fundamentally influenced by the existence of the necessary technology (VLSI).

We find the miniprocessor multisystem educational also from the national viewpoint. Countries more developed than Hungary are also faced with the dilema of choosing the right class or classes of parallel systems. (Rich countries with sophisticated computer technology project ever more and, productinally speaking, ever bolder architectures.) Our experience gained in Japan (Hitachi, Toshiba, etc.) shows that, if a company has significant experience with small machines, then a possible path is to design a multiprocessor system based on such a nonspecialized small machine (Japan, of course, is involved with other architectures as well); i.e., to complement it with all those hardware and software elements through which we set a real multiprocessor system. (This, of course, requires a serious development effort even for a large company.)

We are not going to elaborate on what we mean by "real" multiprocessor system. We merely note that the possibly existing small machine requires significant hardware development (bus system, bus driver, multiple access, dual write, automatic copying, global memory management, etc.) to make the throughput and the response time of the system satisfactory. Softwarewise, the basic configuration implemented should not affect previous characteristics.

To characterize the system, we could mention that in the small-machine category we know several examples where the operating systems of the processor modules are not that different from conventional real-time operating systems (they may even be sold as monoprocessor configurations); however, the modular character of the operating system allows the multiprocessor system to be configured with the so-called multisystem modules connected to the basic system.

In closing, we would like to express the hope that the foregoing developments in connection with the domestic production and use of parallel systems will not remain at the level of discussion but be moved from the level of being individually "housed" to a more coordinated and better organized level by potential developers and manufacturers.

This may be important in national process and production control (which, to be modest, still faces development). In this area, according to practical experience, there is a great need for reliable, fault-tolerant, quick response-time and adaptively configurable systems. Its importance is even greater, since industrial process control and related production control are decisive in the light of the current timeliness of productivity.

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ES 1015 IN PRODUCTION

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 5

[Text] According to the agreement between VIDEOTON and the Computer Technology Coordination Institute (SZKI), in Szekesfehervar, the Experimental Installation Association (SZKUBT) started the production of ES 1015 computers. SZKI, which developed this modern computer tool for the order of VIDEOTON, is havint it manufactured as a distributor, handles the transportation of systems ready for use, their warranty and complete support according to user demands. Relative to these activities, SZKI organized a 3-day seminarium in October in Visegrad. During the event that was rich in meaningful descriptions, demonstrations and evening discussions, Pal Nemeth, Vice Director, and his colleagues informed the potential users of the ES 1015 about the points relative to the production and technical support, etc. of the computer.

New Member of ESR 2 Series

It was mentioned that the experience gained gy SZKI during the development of ES 1010 and 1012 significantly contributed to the successful development of the new computer. That, despite of this, it was not an easy task is illustrated by the following comparisons. While the ES 1010 and 1012 systems required 60, respectively 90 men per year, the ES 1015 required 390. If we take into account the number of the built-in integrated circuits, we have the following figures: 1500, 3500 and 12,500.

The new computer system is the smallest model of the second ESR series. It is fully compatible with the computers of the series, the ESR 1020 of the first series of the ESR and their larger models, and with the members of the IBM 360 and 370 family. It can be effectively used in stand-alone systems and as a station in computer networks. Its system configuration allows local and remote and batch and interactive operating modes. The new multiprocessor, virtual-memory and high-speed computer has a 256-kbyte working storage in the basic configuration. Its arithmetic speed is 20,000 operatins per second. Its instruction repertoire corresponds to the requirements of ESR expansion and, thus, includes floating-point, binary, and decimal arithmetic instructions. To program it, the user can choose from six programming languages. The operating system is virtual memory management ESR DOS-3, but it is capable of using IBM DOS/VS. In the computer, more than one program can be simultaneously executed, since memory protection safeguards the contents of main memory with dynamic lable translation. The compatibility of the ES 1015 provides wide adaptability for the system; its users can count on a wide spectrum of program packages. Characteristically, its floating point operations are of more than average accuracy. The system monitors the correctness of instructions and data during program execution and is able to distinguish between programming errors and hardware faults. Troubleshooting procedures used to remove machine faults involve the correction of faults, the repetition of microinstructions, and the recording of data relative to the condition of the system.

First Ten

In connection with the computer system which can be effectively used in various areas of the national economy and which will soon be on the market, Janos Rudas, department head of SZKI, mentioned that demands presently exceed capacities. Before the end of the year, a total of 10 ES 1015s will be produced. If all [illegible] well, the first five will be put in operation around January - February. The next five machines are planned to be delivered by the end of August.

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TASKS INVOLVED IN REMOTE DATA PROCESSING

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 6

[Article by Dr Josef Gonczy]

[Text] In the past, in our country, remote data processing was characterized by the employment of medium-size (less frequently, medium-large) computers. The computer centers based on thes generally functioned--from the viewpoint of on-line traffic--in an isolated manner; information inflow was handled by local data carriers (e.g., punched tape, magnetic tape, etc.). The results were sent to the user also via off-line means, e.g., continuous printouts (less frequently via magnetic and other type of data carriers).

The technological and technical developments of recent years allow the utilization of new designs and produce new remote data processing tasks which cannot be implemented via conventional methods. The technical possibility for the setting up of remote data processing systems has been enhanced and, at the same time, the remote processing demand has been fiercely increasing.

It has been determined at several management and technical forums that, compared to other achievements in computer technology, remote data processing is falling behind the planned results.

To accelerate catching up, the sixth Five-Year Plan of the Computer Research Goals Program devotes a separate chapter to remote data processing tasks. The chapter summarizes the actions to be taken in two target tasks, the first one being remote network research and development. The second one (the one being described) contains the applications development tasks; they have been accepted by OMFB and KSH as remote data processing application target tasks.

During the preparation of the target task, it was demonstrated that most of the planned remote data processing tasks can be implemented by a star-connected network system built around a large computer; thus, the target task mostly deals with the implementation of this system.

The imported computers of the sixth Five-Year Plan belong basically to the second series of unified computer systems (ESR); in addition, minicomputer systems (MSR) are also imported in significant numbers. Corresponding to the international experience, the user has an increasing demand for the two extreme poles of computational power: ever larger computers (second ESR series, 1 - 2 Mbyte working storage, 6 - 12 100-Mbyte disk units) and minicomputers (MSR series). The role of medium-size ESR machines is decreasing; for this reason, perspective remote data processing development must support the above two areas of application. In addition, the support of remote data processing requirements of the existing machine stock (above all ES 1040 and 1022) must be taken into account; the development tasks relative to this are also a part of Target Task 52.

Goal and Result

The basic goal is the development of remote data processing subsystems based on ESR 1 and ESR 2 computers and needed by company-management users of MSR machines for complex remote data processing tasks; the supporting of their hardware and software requirements; facilitating their broader use and installation; their integration into other systems (operating systems, data base management systems, application program development systems) to make up a unified system.

The result: a remote data processing hardware, basic and system-software module kit is produced, which fits into the peripheral system of ESR software support.

Typical features of the module kit:

--from the remote data processing components corresponding to the application task requirements and from the framework-system modules complex hardware and software systems can be created which are cheap to install and easy to use;

--can be used in complex application systems with MSR and ESR machines;

--the functioning, effectiveness, and easy-to-use character of the remote data processing system components can be demonstrated.

During the implementation of the target task, at the time of the generation of the remote data processing hardware-software system, we must strive for the following:

--must rely on the elements of domestic or ESR production base;

--must be able to be integrated into the peripheral systems providing basic software support for ESR machines, which are set up by the Computer Applications Development Fund (SZAFA);

--must be adapted to the application and program development systems which are already available or are to be acquired;

--must satisfy the remote data processing requirements of the important company, branch-industry and regional managerial systems of the national economy.

In addition to impelemnting at the national level the data base management and data transmission tasks of ESR machines, it must implement the similar tasks of MSR machines while maintaining compatibility with ESR machines. Thus, ESR/MSR level, complex shared application systems can also be created.

Prototypes

To implement the task, remote data processing prototype systems based on ESR 1 and ESR 2 series computers must be created and operated, which contain mostly domestic--or, if necessary, socialist import--remote data processing system components and MSR-based intelligent remote data processing components.

The prototypes allow:

--to demonstrate the functioning and applicability of various remote data processing systems;

--the testing and system integration of remote data processing system components manufactured by various companies;

--the testing and system integration of new units developed or acquired for the software peripheral systems;

--to provide future remote data processing users with machine capacity, which facilitates the training of users and the installation of their computer, moreover, after the adjustment of the installed computer, support the users to reach full capacity.

In the framework of the target task, we are planning the production of two prototype systems, which are decidedly based on present devices of OSZV; the acquisition of equipment necessary for the expansion is in progress.

Structure of the ESR 1-based prototype remote data processing system:

--ES 1022 computer with 512-kbyte main memory;

--29 Mbyte magnetic disk;

--ES 8410 TERTA multiprocessor;

--VIDEOTON, TERTA, ORION terminals.

Structure of the ESR 2-based prototype system:

--ES 1055 computer with 1 Mbyte main memory;

--100 Mbyte magnetic disk;

--ES 8371.01 TELE JS remote data processor;

--MERA individual and group terminals;

--VIDEOTON, TERTA, ORION terminals.

For both systems, as intelligent terminals, we would like to use MSR (SM-4) minicomputers. In the selection of terminals, we consider two significant points: one, to avoid software problems, we strive for as perfect compatibility with IBM terminal management as possible; two, due to the demonstrative and referential nature of the prototype systems, we would like to use all terminal types suitable for service to increase device choice.

The following tasks must be implemented to create the prototype systems and reach further long-range goals:

--testing ans possibly necessary adaptation of remote data processing hardware devices needed by the prototype systems;

--integration of the corresponding software modules (modifications), which serve the hardware units, into the peripheral system providing the domestic ESR software supply;

--integration of interactive program development and remote off-line program execution tools into the peripheral system;

--selection of remote data processing monitor, its adaptation to and interface with data base systems, the support of domestic remote data processing elements;

--employment of an MSR computer for terminal emulation, provision of remote data processing service system programs for the MSR;

--concrete software support for the ESR 1 and ESR 2 prototype systems via the established peripheral systems, the preparation of data-base and data-transfer interactive demonstrator programs;

--preparation of application data-base and data-transfer sample systems for the measuring of installation efficiency;

--integration of prototype-system services into the services of other ESR and IBM computers;

--benefiting from the accomplishments made during the implementation of the network remote data processing target task (Target Task 51) of the SZKCP and the integration of software products into the peripheral system.

The last two tasks will not be handled until the second half of the planning period: these questions so beyond the star remote-data-processing system and point to network applications.

Financial Sources

The target-task plan composed by SZAMKI and OSZV has been accepted at the necessary forums; the financial support necessary for the implementation will be provided by KSH, OMFB, the Ministry of Industry and MTA; in addition, significant expenses will be covered by the institutions managing and implementing the task (OSZV, SZAMKI, SZAMOK). Contracts have been drawn up for the concrete provision of financial coverage; in the execution of the work program until 1985, a wide spectrum of the national computer institutions participates; the preparation of the contract system resulting in the division of the work is in progress.

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MULTILEVEL INFORMATION PROCESSING SYSTEM BASED ON ESR AND MSR EQUIPMENT

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 7

[Text] The article presents the hierarchical computer system, consisting mostly of ESR and MSR hardware and software components. The first part deals with the theoretical structure of the system; the second part presents a specific application.

Structure

The system is divided into three levels (figure 1): on level 1, we find the central processing system. Its task is to control a network consisting of 30 regional centers, route messages between regional centers and collect and process data from the centers. The displays concerning the total system and summaries are prepared, and the archive data base resides here.

The regional centers accept and process in accordance with the given area the data received from the lowest level and transfer the compiled information to the upper level. The active data bases of the system function in a decentralized manner in these regional centers. A further task is the preparation of regional summaries. The main task of the local data stations is the preliminary processing of data. In the process of doing this, they can communicate with the data base of the system. The gathered source information can be transferred either to the regional center situated on the individual line or to the central system. The local data station prepares the result evaluations and summaries for the given subunit.

There is a telephone connection between certain levels of the hierarchy; the data transfer speed is 1200 bauds at the minimum.

The main hardware unit of the central data processing system is some second-series large ESR computer (ES 1035, ES 1045, ES 1055, ES 1060, etc.). The operating system used is a version of ES OS 6.1. The message switching of the regional centers is handled by an increased-reliability (dual-processor) SM-4 system. For this purpose, the special software created based on the message-switching and data-collection analogy is used. The interface between the ESR and MSR machines is accomplished via an adapter corresponding to the DUP 11 and CX11.

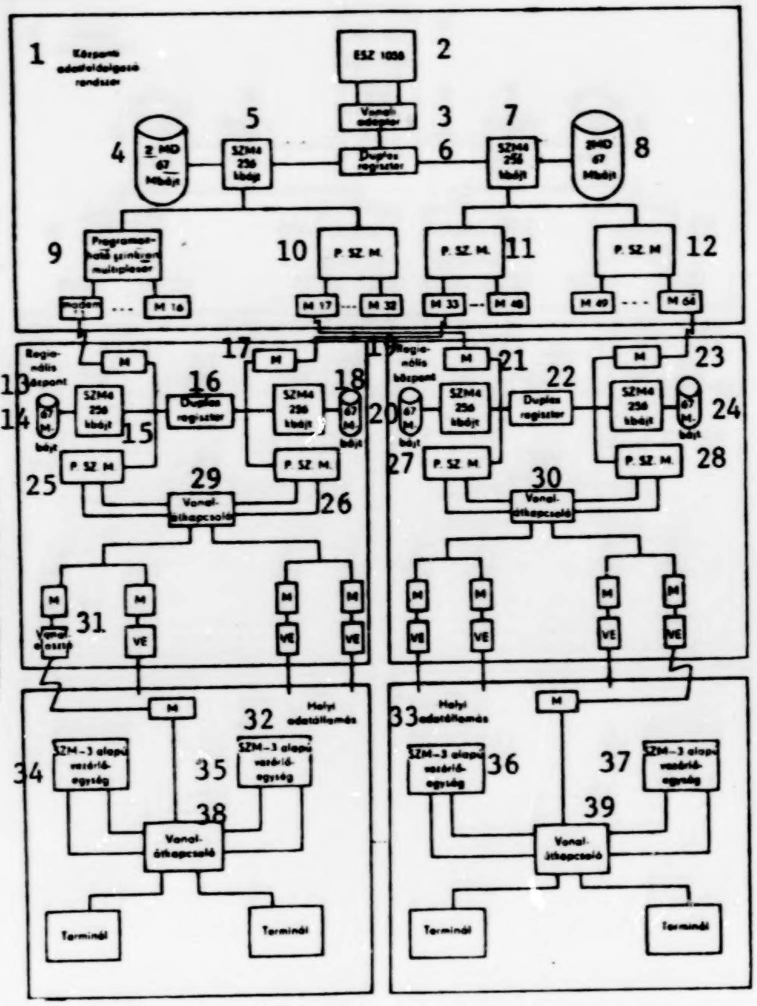

Figure 1. Multilevel System Outline

Key:

1. Central Data Processing System
2. ES 1055
3. line adapter
4. 2 MD 67 Mbyte
5. SM4 256 kbyte
6. duplex register
7. SM4 256 kbyte
8. 2 MD 67 Mbyte
9. programmable synchronous multiplexer
10. PSM
11. PSM
12. PSM
13. Regional Center
14. 67 Mbyte
15. SM4 256 Kbyte
16. duplex register
17. SM4 256 kbyte
18. 67 Mbyte
19. Regional Center
20. 67 Mbyte
21. SM4 256 kbyte
22. duplex register
23. SM4 256 kbyte
24. 67 Mbyte
25. PSM
26. PSM
27. PSM
28. PSM
29. line switch
30. line switch
31. line distributor
32. Local Data Station
33. Local Data Station
34. SM-3-based control unit
35. SM-3-based control unit
36. SM-3-based control unit
37. SM-3-based control unit
38. line switch
39. line switch

In the regional centers, dual-machine SM-4 systems are used; these are equipped with the tools necessary for remote processing. The operating system software of the system corresponds to the DEC RSX 11M.

One possible hardware implementation of the local data stations involves the use of dual SM-3M systems. On the software side, a real-time operating system is needed. In the implementation of the above structure, it is possible (and necessary) to use a few tools imported from the West. Such are the 67-Mbyte magnetic disk of Control Data and the TC-800 terminal of Olivetti.

Moscow Example

A typical design of multilevel hierarchical computer systems is found in the Moscow savings bank. The task of the GTSK-Moscow system (henceforth referred to as "system") is the performance of customer-related services--deposits, withdrawals, interest computations, etc.--and the execution of the related accounting functions, preparation of summaries.

The number of the savings bank locations served exceeds 3,000. There are 2 - 12 workstations--depending on the nature and quantity of the work to be done--in the savings bank branches. A central savings bank has 32 branches. The number of personal accounts handled exceeds 8 million. The yearly growth rate is 5 percent. The performance of data processing tasks is done in the batch mode; customer services are on-line. In the central savings bank, in addition to customer services, the data base of the deposit accounts is managed; summaries are prepared and bookkeeping functions are performed.

The system is implemented at two levels (figure 2). On the upper level, we find the dual-machine SM-4 systems of the central savings banks with the devices necessary for the message-switching and controlling of the terminals. The terminals are Olivetti-800 devices. The remote processing functions of the system are performed via telephone lines.

What requirements should the software of the system satisfy?

Reliability and recovery; forging data collection, formatting, input, storage and processing into a unified process, the appropriate supervision of individual steps; expansion capability; security; easy use. The SM-4 subsystem employs the well-known RSX-11M operating system. The TC 800 has two operating systems: the batch-mode DOS and the real-time COSMOS.

From the application software of the TC 800, we highlight the ZTM and INCAS program packages. ZTM plays a role in data input and output and screen formatting. INCAS handles in the on-line mode the controlling of common peripherals, processing of operational failures and dialog control.

System monitors ensuring the functioning of the SM-4 application software:

--The system can function as a terminal concentrator with the aid of SKLS. It ensures transit, local and mixed switching mode. The concentrator mode can be dynamically changed.

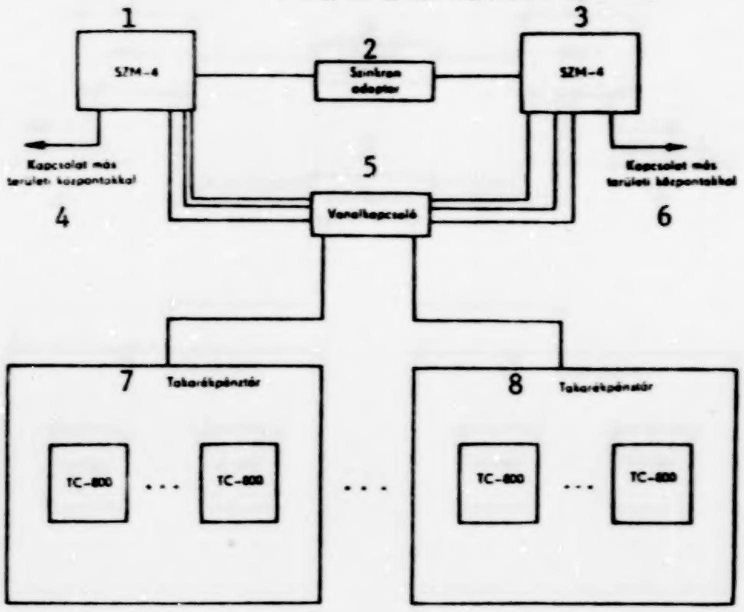

Figure 2. Structure Outline of Area System

Key:

1. SM-4
2. Synchronous adapter
3. SM-4
4. Connection to other area centers
5. Line switch
6. Connection to other area centers
7. Savings bank
8. Savings bank

--The SOT transaction monitor serves for the automation of the work connected with the archive files. It accepts messages from local and remote terminals, processes them, manages the user and system files, completes the restart and recovery process.

--The savings bank system significantly improves the services provided to the population. It makes any personal account accessible. The opportunity is offered for the reduction of cash transactions, which allows the transferring of supplementary money bases.

The system offers valuable experiences in the use of multilevel networks. It provides especially good reference for SM 4 computers. At the same time, at the highest level, it does now, however, show the connection to ESR systems in its present design. In spite of this, it proves that MSR technology is suitable for the implementation of the most modern computer technological structures.

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